Cruise Ship Infection Control

The headlines come round with a depressing and monotonous regularity. Cancelled voyages, destroyed holidays, ships confined to port or not allowed into port, passengers confined to cabins. There is an ever increasing list of nasty, and some potentially fatal, infections that proliferate with ease in the confines of passenger carrying vessels. Cruise ship infection control seems forever topical.

Vomiting bug, novovirus, and now coronavirus (Covid-19) seem to be able to easily get a foot hold in the densely populated, mixed ethnicity, environment of cruise ships. These infections have various routes for transmission from person to person and one route for the respiratory type infections is through the air in the form of the virus contained in airborne droplets. Cruise ship infection control has several dimensions and it seems that the one dimension is largely overlooked.

The ventilation systems in ships conform to various industry standards which although in some respects are unique to the marine application, are in other respects very similar to the standards for buildings on land. Here you will find information about temperature regulation, ventilation operation, air change rates amongst other details but nothing on the prevention of air borne infections. This is a pity because the networks of ducting that supply air to the occupied spaces would be an obvious conduit for the supply of infectious bio-aerosols from one part of the ship to the other. In the methodology for effective cruise ship infection control, this transmission route warrants serious consideration.

Fresh air is ducted into cabins and used (potentially contaminated) air is ducted out, collected into a manifold and then after filtration and other treatment is ducted back cabins or to communal areas often after mixing with fresh air.

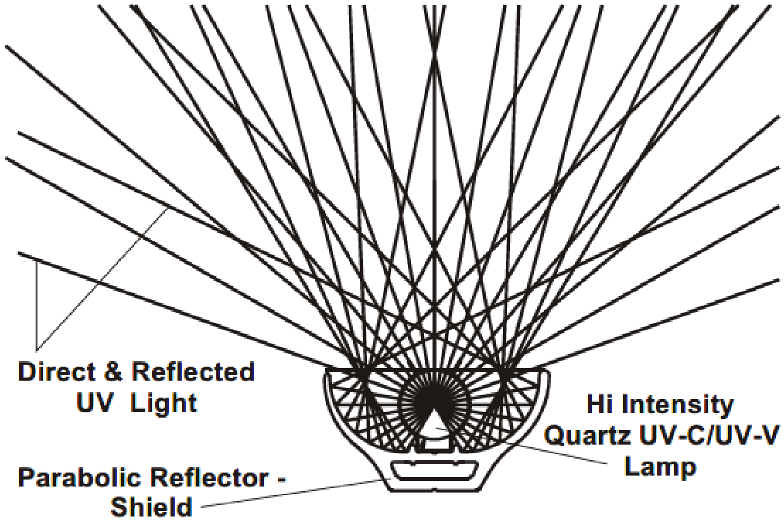
If the supply of air to the ships communal spaces and the cabins was 100% fresh, like for instance could be found in a typical modern hospital, then the ducting could not be a conduit for the internal bio-aerosols. But the problem is that much of the air supplied to these areas will be return air that has been mixed with a percentage of fresh air before being filtered (not by the sort of thing that can catch airborne viruses!) and distributed though ducting manifolds to the occupied spaces on the ship.

Operators and builders of ships like those of large structures on land are under increasing regulatory pressure to be cleaner and more efficient, so the efficiency of generating and retaining heat is important. This is why relatively warm return air is typically recirculated. In more recent years air handling units are being fitted with heat recovery systems. This is a step forward because it means that air supply can be 100% fresh with heat being largely recovered from the outgoing return air.

Example of a Central Air Handling Unit. These are modular and can be built together on site to the customers specifiactions this package might handle 100,000m3/h dependant on operating conditions
But even with 100% fresh air through a heat exchanger there could still be an issue undermining the cruise ship infection control efforts.

Heat exchangers can be one of a number of types. Cross-flow heat exchangers and 'run around' heat transfer coils ensure that the surfaces exposed to the outgoing air are kept separate to the surfaces exposed to the fresh air. Rotating heat exchangers on the other hand have a shared surface and that surface is huge. Rotating heat exchangers are very common in modern air handling units and can be found on ships. Rather than being absent from the cruise ship infection control strategy – out of sight out of mind – it needs to be front and central. Let me explain…

Multiple Coil-clean units in operation



The coil cleaner's reflector ensures full coverage of the target area

Return air with heat and some level of bio-aerosol content passes through tiny flutes in the rotating wheel. The fluted wheel warms in the outgoing air and there is every possibility of bio-aerosols coming to settle on the surface of the wheel that the passes through. The wheel continues to turn and passes into the supply air sector of the air handling unit. The wheels' fluted surface complete with potentially harmful viral contaminant is exposed to the fresh air and it is perfectly possible for viruses to be readmitted into the ships ventilation ducts.

Why would a operator of an e-commerce website be banging on about cruise ship infection control?

Well here's our beef…

For years ultra violet light has been used to kill biological contaminants in air moving through ducting, on cooling coils and even on food and pharmaceutical production systems. Its use in North America is so well understood and known about that it even warrants its own chapter in the ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) handbook.

In the US it is even a requirement that air handling units fitted to public buildings in the US are fitted with UV lamps to keep the cooling coils basked in UV light. Yet from the marine and ship building market there is not a glimmer of interest in this technology.

To those of us in the UV supply sector this technology used on rotary heat exchangers and in supply ducts in ships is an obvious application. A 'no brainer'.

The UV lamps sit in the airflow in the middle of the duct

Sanuvox Quattro-GX in-duct air purifier. The panel is visible outside the duct.

UV is versatile and powerful tool to keep ventilation systems biologically clean. It has even been proven capable of keeping building occupants safe from terrorist attacks aiming to use building ventilation systems for dispersion of anthrax or other dangerous bio-aerosols (a far more challenging problem).

We wonder why it is that cruise ship infection control specialists don’t use UV for the cruise ship ventilation systems?